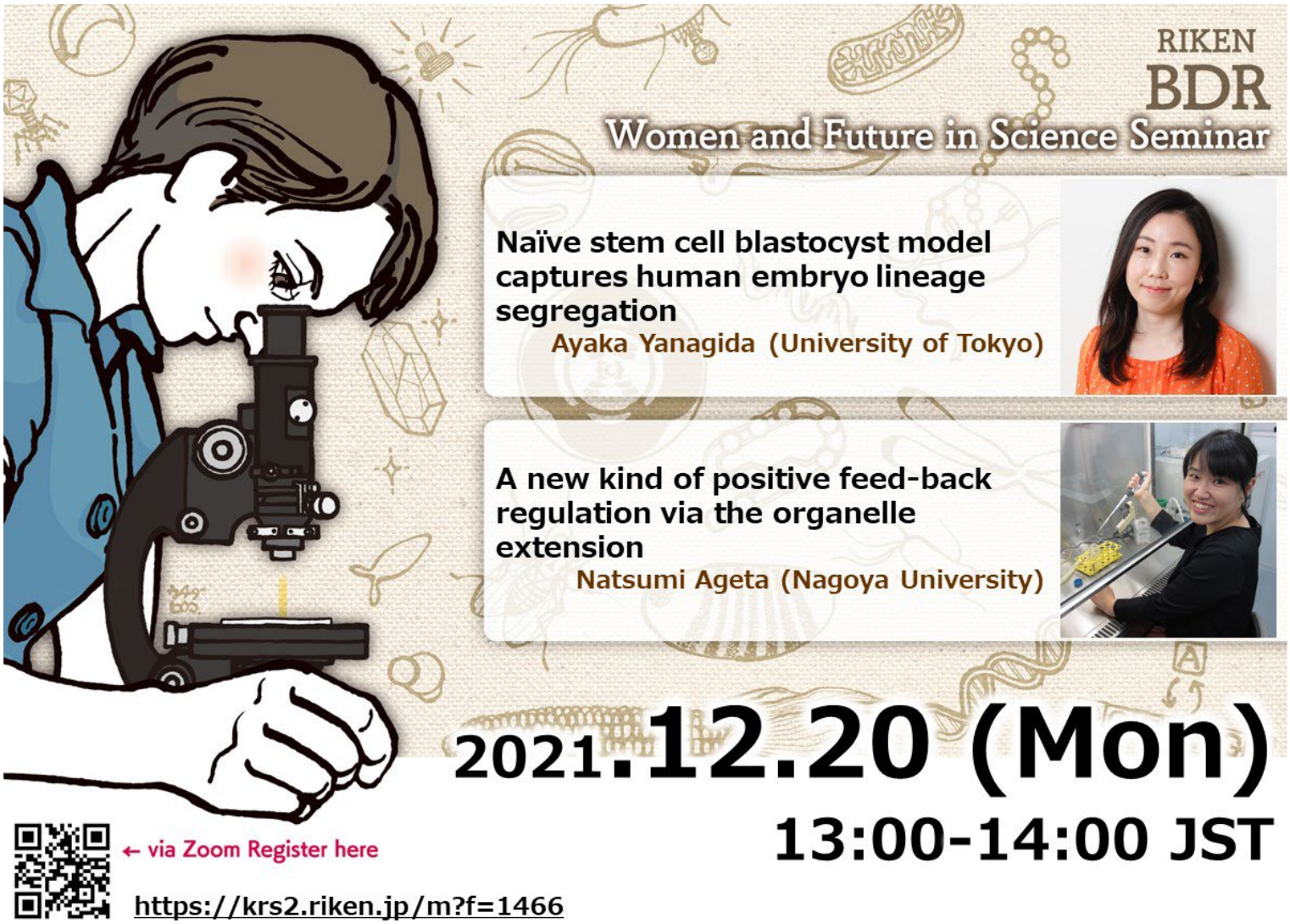

Naïve stem cell blastocyst model captures human embryo lineage segregation

How does a single cell give rise to a human being? In order to answer this fundamental question, it is important to understand how the cells make decisions in the right way at the right time in the right place during the development. However, natural development of the human embryo is challenging to study *in vivo*, and few embryos are available for research *in vitro*. Human naive pluripotent stem cells resemble pre-implantation epiblast (founder of the foetus). They can be derived from pre-implantation embryos (blastocyst) or generated from conventional primed pluripotent stem cells by resetting or from somatic cells by reprogramming. They can differentiate into extraembryonic trophectoderm (founder of the placenta) and hypoblast (founder of the yolk sac). Here we discovered a human embryo model (blastoid) generated by self-organisation of human naïve pluripotent stem cells. Brief induction of trophectoderm leads to formation of blastocyst-like structures within 3 days. Blastoids are composed of three tissue layers displaying exclusive lineage markers, mimicking the natural blastocyst. Single-cell transcriptome analyses confirm segregation of trophectoderm, hypoblast, and epiblast with high fidelity to the human embryo. This versatile and scalable system provides a robust experimental model for human embryo research.

A new kind of positive feed-back regulation via the organelle extension

Since organelles are involved in various biological processes, and functional damage results in diseases, research on organelle functions is ongoing. However, few studies have focused on organelle migration linked to biological responses.

Short-term and long-term memories (STM and LTM) are characterized respectively by the independence and dependence on protein translation. Likewise, long-term potentiation (LTP) of synaptic transmission, a neural substrate of memory, comprises early-phase and late-phase components (E-LTP and L-LTP). It is postulated that the transition from E-LTP to L-LTP at the synapse level is responsible for the conversion from STM to LTM (memory consolidation) at the behavior/organism level. However, synapse mechanisms underlying memory consolidation remain unclear.

Ubiquitous nucleotide-binding cytoskeletal polymers composed of septins are poorly characterized despite their abundance in the brain. We reported that septin cytoskeleton plays a pleiotropic role in developmental neuritogenesis and postdevelopmental synaptic transmission (Ageta-Ishihara et al., Nature Communications 2013, 2015, Neurochemistry International 2018, Neuroscience Research 2021). In this seminar, we will demonstrate the activity- and septin-dependent organelle extension into dendritic spines as a synaptic mechanism of transition from E-LTP to L-LTP. This finding illuminates positive feed-back regulation, which is the basis for long-term memory formation, is triggered by organelle elongation.

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